Question Number	Scheme	Marks
	$g(x) = 3x - 5 + 5\sin\left(x^2\right)$	
1 (a)	$g(0.7) = -0.55, \quad g(0.8) = 0.39$	M1
	Change of sign and continuous function, hence root in $[0.7, 0.8]$	A1
		(2)
(b)	$0 = 3x - 5 + 5\sin\left(x^2\right) \Rightarrow x = \left[\arcsin\left(1 - 0.6x\right)\right]^{\frac{1}{2}}$	B1
		(1)
(ci)	$x_2 = \left[\arcsin\left(1 - "0.6" \times 0.7\right)\right]^{\frac{1}{2}} = \text{awrt } 0.7866$	M1, A1
(cii)	$\alpha = 0.7589$	A1
		(3)
		(6 marks)

(a)

M1 Attempts the value of g at 0.7 and 0.8 with one correct (to 1 s.f. rounded or truncated). Use of a narrower range is possible, providing the lower x value gives a negative function value and the higher one gives a positive function value. You may need to check these function values.

A1 Requires

- Both values correct to 1 s.f., rounded or truncated.
- Reason: sign change (or $g(0.7) < 0, g(0.8) > 0$ or $g(0.7)g(0.8) < 0$, etc) and "continuous function" (or "continuous graph/curve", or just "continuity" etc.)
- Minimal conclusion, e.g. "root", "solution", "root in interval", "root in [0.7,0.8]", "α lies in interval", etc). Do not condone the incorrect statement "Change of sign hence continuous function and root in interval" etc.

(b)

B1 Correct value of p stated or implied. May be embedded in formula. If embedded, allow e.g. $-\frac{3x}{5}$ in place of $-0.6x$. Condone slips in the formula if the correct value of p is clearly seen. If an incorrect p value is seen in (b) it is B0, regardless of what the candidate uses in (c). If there is no obvious attempt at (b), then you can mark any formula used in (c). Apply isw if, for example, a correct formula is given, followed by $p = -0.6$.

(ci)

M1 Attempts to substitute $x_1 = 0.7$ into the correct formula with their $\pm p$ to reach a value. Do not be concerned about the labelling of this second approximation, e.g. it may be labelled x_1 or x_3. This mark is available for candidates working in degrees, in which case, if a correct formula is used, they will get $x_2 = 5.954$. For an incorrect formula and no working, you may have to check their answer, whether working in radians or degrees.
Can be implied by 0.786... following $p = 0.6$

A1 awrt 0.7866. Condone incorrect labelling.

(cii)

A1 cao $\alpha = 0.7589$. Accept $x = 0.7589$ or e.g. $x_{11} = 0.7589$ if it is clear this is their final answer.

Question Number	Scheme	Marks
2 (i)	$y = x^2 \ln 2x \Rightarrow \left(\dfrac{\mathrm{d}y}{\mathrm{d}x} =\right) 2x\ln 2x + x$ o.e.	M1 A1
(ii)	$\left(\mathrm{f}'(x) =\right) \dfrac{2(4x+3)^2\mathrm{e}^{2x} - 8(4x+3)\mathrm{e}^{2x}}{(4x+3)^4}$ or $2\mathrm{e}^{2x}(4x+3)^{-2} - 8\mathrm{e}^{2x}(4x+3)^{-3}$	M1 A1
	$= \dfrac{\cancel{(4x+3)}\mathrm{e}^{2x}[2(4x+3)-8]}{(4x+3)^{\cancel{3}}}$ or $\mathrm{e}^{2x}(4x+3)^{-3}[2(4x+3)-8]$	dM1
	$= \dfrac{2\mathrm{e}^{2x}(4x-1)}{(4x+3)^3}$	A1
		(6 marks)

(i)

M1 Attempts the product rule to achieve $Ax\ln 2x + Bx$ o.e. with $A, B \neq 0$ which may be unsimplified.

A1 $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x} =\right) 2x\ln 2x + x$. Condone $\ln 2x(2x) + x$. isw after a correct answer.

(ii)

M1 Attempts the quotient rule to achieve $\dfrac{P(4x+3)^2\mathrm{e}^{2x} - Q(4x+3)\mathrm{e}^{2x}}{(4x+3)^4}$ with $P, Q > 0$. Allow $-Q(4x+3)\mathrm{e}^{2x}$ to be expanded, i.e. if correct $-(32x+24)\mathrm{e}^{2x}$ or $-32x\mathrm{e}^{2x} - 24\mathrm{e}^{2x}$.

Alternatively, attempts the product rule. Look for $P\mathrm{e}^{2x}(4x+3)^{-2} - Q\mathrm{e}^{2x}(4x+3)^{-3}$ with $P, Q > 0$.

In either case, Q may be written as the product of two integers.

Condone miscopying slips on $(4x+3)$, e.g. $(3x+4)$

A1 Using quotient rule: $\left(\mathrm{f}'(x) =\right) \dfrac{2(4x+3)^2\mathrm{e}^{2x} - 8(4x+3)\mathrm{e}^{2x}}{(4x+3)^4}$ o.e.

Using product rule: $\left(\mathrm{f}'(x) =\right) 2\mathrm{e}^{2x}(4x+3)^{-2} - 8\mathrm{e}^{2x}(4x+3)^{-3}$ o.e.

In either case, allow 8 to be written as (2)(4).

dM1 Dependent on previous M1. Correctly takes out a common factor of $(4x+3)\mathrm{e}^{2x}$ from their numerator and cancels $(4x+3)$. If using product rule, must take out a common factor of $(4x+3)^{-3}\mathrm{e}^{2x}$. They may also take out a factor of 2 at this stage, but this is not required for dM1.

A1 Achieves $\dfrac{2\mathrm{e}^{2x}(4x-1)}{(4x+3)^3}$. Do not allow $2\mathrm{e}^{2x}(4x-1)(4x+3)^{-3}$. Allow recovery of invisible brackets at any stage.